



## Features

- Extremely high speed performance
- Blocks high voltages and currents
- Two TBU® protectors in one small package
- Simple, superior circuit protection
- Minimal PCB area
- RoHS compliant\*, UL Recognized



Bourns® Model P850-G Series TBU® HSPs are not recommended for POTS applications. This series is suited for applications requiring a dual bidirectional device where 50 ohms of series resistance is acceptable. For new SLIC applications, we recommend that customers evaluate our [TBU-PL Series](#).

## P850-G Series Dual TBU® High-Speed Protectors

### Transient Blocking Units - TBU® Devices

Bourns® Model P850-G TBU® products are dual high-speed bidirectional protection components, constructed using MOSFET semiconductor technology, designed to protect against faults caused by short circuits, AC power cross, induction and lightning surges.

The TBU® high speed protector, triggering as a function of the MOSFET, blocks surges and provides an effective barrier behind which sensitive electronics are not exposed to large voltages or currents during surge events. The TBU® device is provided in a surface mount DFN package and meets industry standard requirements such as RoHS and Pb Free solder reflow profiles.

### Agency Approval

UL recognized component File # E315805.

### Industry Standards

Description		Model
<b>Telcordia</b>	GR-1089 Port Type 3, 5	P850-G
<b>ITU-T</b>	K.20, K.20E, K.21, K.21E, K.45	P850-G

### Absolute Maximum Ratings ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ )

Symbol	Parameter	Value	Unit
$V_{imp}$	Maximum protection voltage for impulse faults with rise time $\geq 1\text{ }\mu\text{sec}$	850	V
$V_{rms}$	Maximum protection voltage for continuous $V_{rms}$ faults	425	V
$T_{op}$	Operating temperature range	-40 to +85	$^{\circ}\text{C}$
$T_{stg}$	Storage temperature range	-65 to +150	$^{\circ}\text{C}$

### Electrical Characteristics ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ )

Symbol	Parameter	Model	Min.	Typ.	Max.	Unit
$I_{op}$	Maximum current through the device that will not cause current blocking	P850-G120-WH P850-G200-WH			100 200	mA
$I_{trigger}$	Typical current for the device to go from normal operating state to protected state	P850-G120-WH P850-G200-WH		150 275		mA
$I_{out}$	Maximum current through the device	P850-G120-WH P850-G200-WH			200 400	mA
$R_{device}$	Series resistance of the TBU® device			50	55	$\Omega$
$R_{bal}$	Line-to line series resistance difference between two TBU® devices				2	$\Omega$
$t_{block}$	Maximum time for the device to go from normal operating state to protected state				1	$\mu\text{s}$
$I_{quiescent}$	Current through the triggered TBU® device with 50 Vdc circuit voltage			0.7		mA
$V_{reset}$	Voltage below which the triggered TBU® device will transition to normal operating state			22		V

The P-G series TBU® devices are bidirectional; specifications are valid in both directions.



**WARNING Cancer and Reproductive Harm**  
[www.P65Warnings.ca.gov](http://www.P65Warnings.ca.gov)

\*RoHS Directive 2002/95/EC Jan. 27, 2003 including annex and RoHS Recast 2011/65/EU June 8, 2011. Specifications are subject to change without notice. Users should verify actual device performance in their specific applications. The products described herein and this document are subject to specific legal disclaimers as set forth on the last page of this document, and at [www.bourns.com/docs/legal/disclaimer.pdf](http://www.bourns.com/docs/legal/disclaimer.pdf).

## Applications

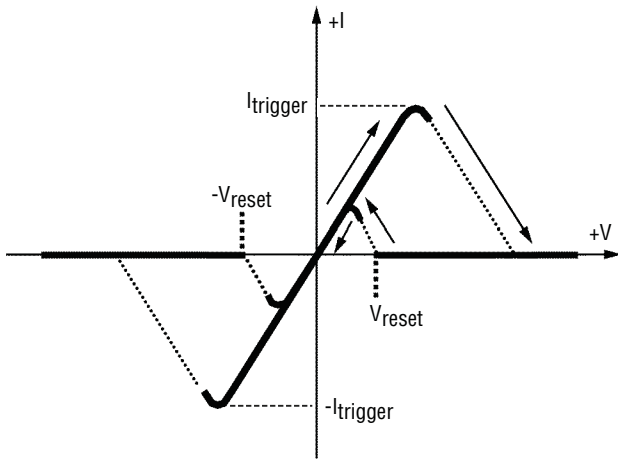
- Sensor protection
- Signal line protection

# P850-G Series Dual TBU® High-Speed Protectors

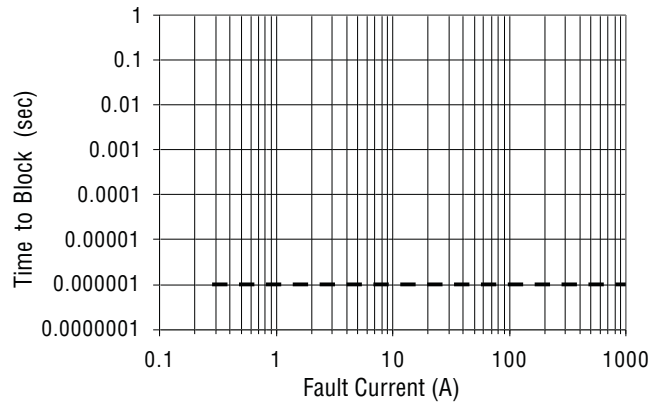
**BOURNS®**

### Typical Performance Characteristics

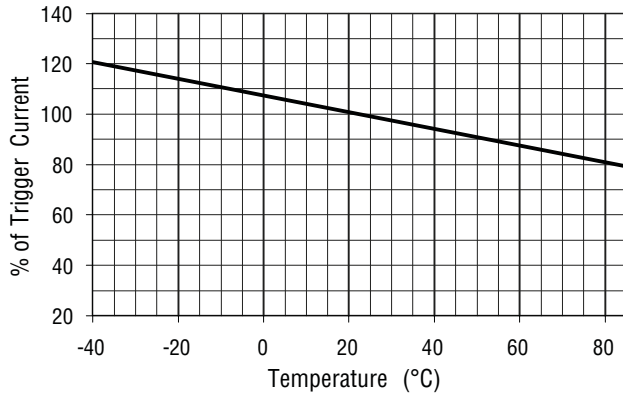
#### V-I Characteristics



#### Time to Block vs. Fault Current



#### Trigger Current Temperature



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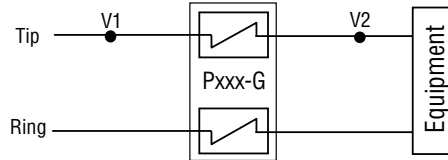
# P850-G Series Dual TBU® High-Speed Protectors



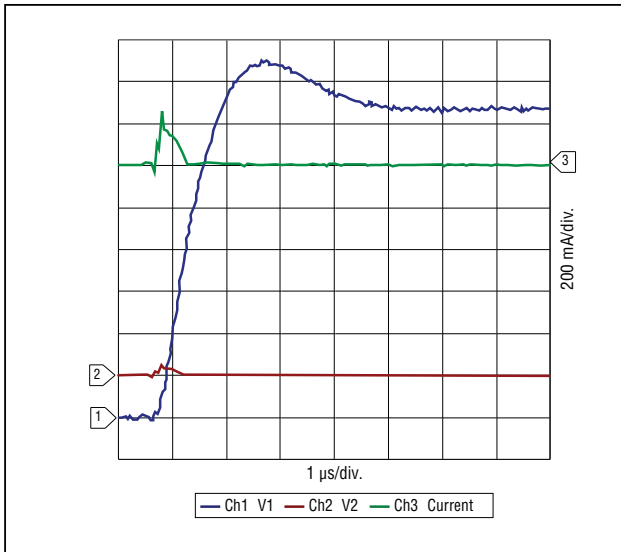
## Operational Characteristics

The graphs below demonstrate the operational characteristics of the TBU® device. For each graph the fault voltage, protected side voltage, and current is presented.

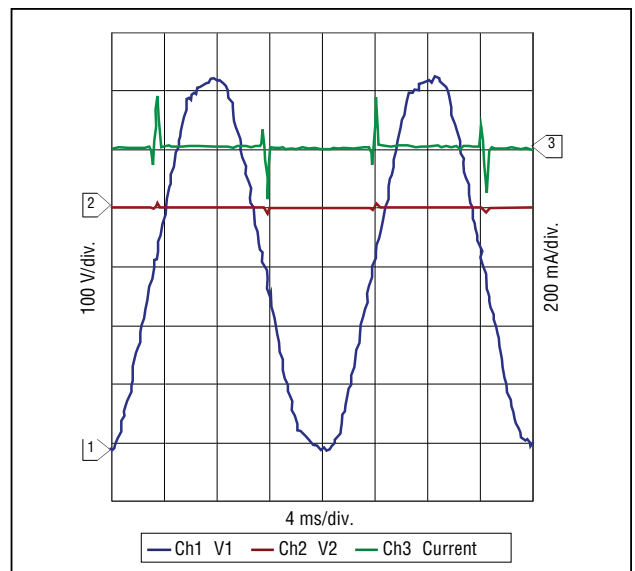
TEST CONFIGURATION DIAGRAM



P850-G Lightning, 850 V



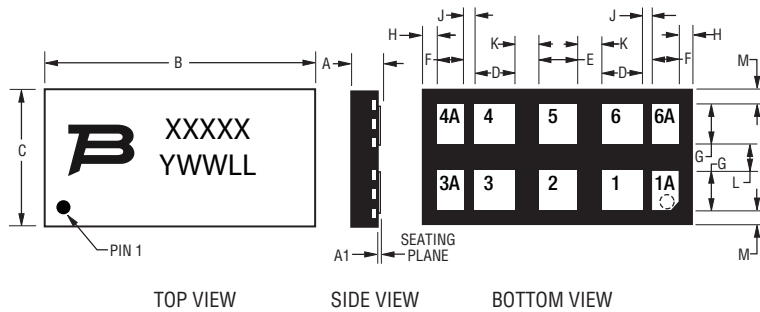
P850-G Power Fault, 230 Vrms, 25 A



# P850-G Series Dual TBU® High-Speed Protectors

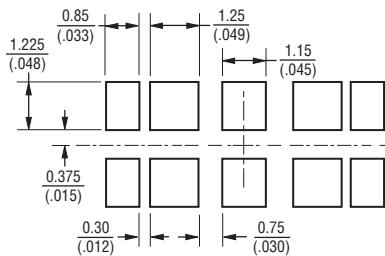
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## Product Dimensions



Pads 1A and 1 are internally connected; the same for pads 3A with 3, 4A with 4, and 6A with 6. This allows for one PCB layout to accommodate the Model P850.

## Recommended Pad Layout



### Pad Designation

Pad #	Apply	Pad #	Apply
1A	Tip In	4A	Ring Out
1	Tip In	4	Ring Out
2	NC	5	NC
3	Tip Out	6	Ring In
3A	Tip Out	6A	Ring In

NC = Solder to PCB; do not make electrical connection, do not connect to ground.

Dim.	P850-G		
	Min.	Typ.	Max.
A	0.80 (.031)	0.90 (.035)	1.00 (.039)
A1	0.00 (.000)	0.025 (.001)	0.05 (.002)
B	8.15 (.321)	8.25 (.325)	8.35 (.329)
C	3.90 (0.154)	4.00 (0.157)	4.10 (0.161)
D	1.15 (.045)	1.25 (.049)	1.35 (.053)
E	1.05 (.041)	1.15 (.045)	1.25 (.049)
F	0.725 (.029)	0.825 (.032)	0.925 (.036)
G	1.10 (.043)	1.20 (.047)	1.30 (.051)
H	0.375 (.015)	0.425 (.017)	0.475 (.019)
J	0.25 (.010)	0.30 (.012)	0.35 (.014)
K	0.70 (.028)	0.75 (.030)	0.80 (.031)
L	0.70 (.028)	0.75 (.030)	0.80 (.031)
M	0.375 (.015)	0.425 (.017)	0.475 (.018)

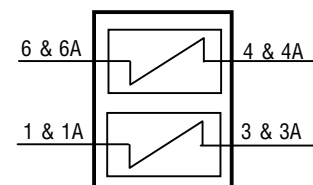
TBU® devices have matte-tin termination finish. Suggested layout should use non-solder mask define (NSMD). Recommended stencil thickness is 0.10-0.12 mm (.004-.005 in.) with stencil opening size 0.025 mm (.0010 in.) less than the device pad size. As when heat sinking any power device, it is recommended that, wherever possible, extra PCB copper area is allowed. For minimum parasitic capacitance, do not allow any signal, ground or power signals beneath any of the pads of the device.

DIMENSIONS:  $\frac{\text{MM}}{\text{(INCHES)}}$

## Thermal Resistances

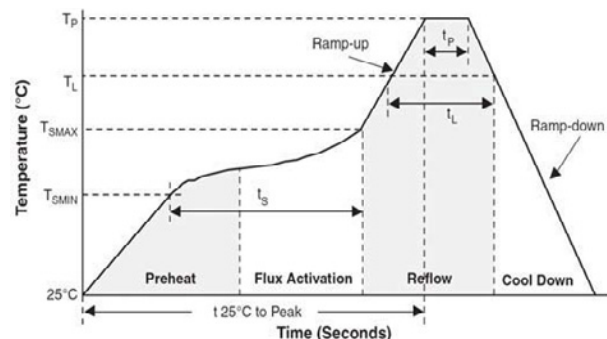
Part #	Symbol	Parameter	Value	Unit
P850-G	Rth(j-a)	Junction to leads (package)	119	°C/W
		Junction to leads (per TBU® device)	215	°C/W

## Block Diagram



## Reflow Profile

Profile Feature	Pb-Free Assembly
Average Ramp-Up Rate (T <sub>SMAX</sub> to T <sub>p</sub> )	3 °C/sec. max.
Preheat	
- Temperature Min. (T <sub>Smin</sub> )	150 °C
- Temperature Max. (T <sub>Smax</sub> )	200 °C
- Time (t <sub>Smin</sub> to t <sub>Smax</sub> )	60-180 sec.
Time maintained above:	
- Temperature (T <sub>L</sub> )	217 °C
- Time (t <sub>L</sub> )	60-150 sec.
Peak/Classification Temperature (T <sub>p</sub> )	260 °C
Time within 5 °C of Actual Peak Temp. (t <sub>p</sub> )	20-40 sec.
Ramp-Down Rate	6 °C/sec. max.
Time 25 °C to Peak Temperature	8 min. max.



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# P850-G Series Dual TBU® High-Speed Protectors

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## How to Order

**P 850 - G 120 - WH**

Form Factor \_\_\_\_\_

P = Two TBUs® protectors in one device

Impulse Voltage Rating \_\_\_\_\_

850 = 850 V

Directional Indication for Paired Devices \_\_\_\_\_

G = Bidirectional

Top Indicator \_\_\_\_\_

120 = 100 mA

200 = 200 mA

## Typical Part Marking



5 DIGIT PRODUCT CODE:

- 1ST DIGIT INDICATES PRODUCT FAMILY.
- 8 = P850-G SERIES

- 2ND & 3RD DIGITS INDICATE IMPULSE VOLTAGE.
- 4TH & 5TH DIGITS INDICATE TRIGGER CURRENT.

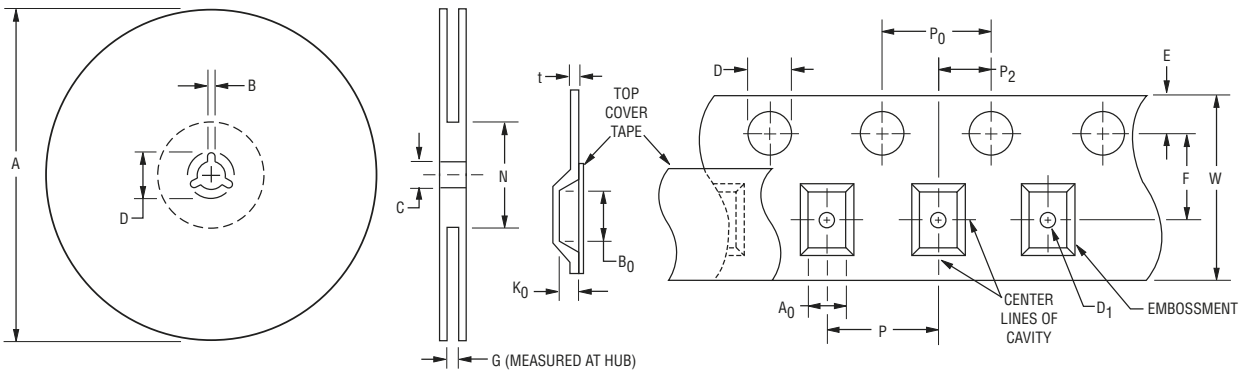
MANUFACTURING DATE CODE:

- 1ST DIGIT INDICATES THE YEAR.

- 2ND & 3RD DIGITS INDICATE THE WEEK NUMBER.

- 4TH & 5TH DIGITS INDICATE LOT CODE.

## Packaging Specifications (per EIA468-B)



USER DIRECTION OF FEED  
QUANTITY: 3000 PIECES PER REEL

A		B		C		D		G	N
Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Ref.	Ref.
326	330.25	1.5	2.5	12.8	13.5	20.2	-	16.5	102
(12.835)	(13.002)	(.059)	(.098)	(.504)	(.531)	(.795)		(.650)	(4.016)

A <sub>0</sub>		B <sub>0</sub>		D		D <sub>1</sub>		E		F	
Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	max.
4.2	4.4	8.45	8.65	1.5	1.6	1.5	-	1.65	1.85	7.4	7.6
(.165)	(.173)	(.333)	(.341)	(.059)	(.063)	(.059)		(.065)	(.073)	(.291)	(.299)
K <sub>0</sub>		P		P <sub>0</sub>		P <sub>2</sub>		t		W	
Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
1.1	1.3	7.9	8.1	3.9	4.1	1.9	2.1	0.25	0.35	15.7	16.3
(.043)	(.051)	(.311)	(.319)	(.159)	(.161)	(.075)	(.083)	(.010)	(.014)	(.618)	(.642)

DIMENSIONS:  $\frac{\text{MM}}{\text{(INCHES)}}$

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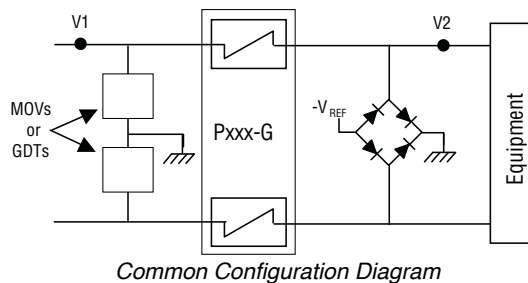
# P850-G Series Dual TBU® High-Speed Protectors

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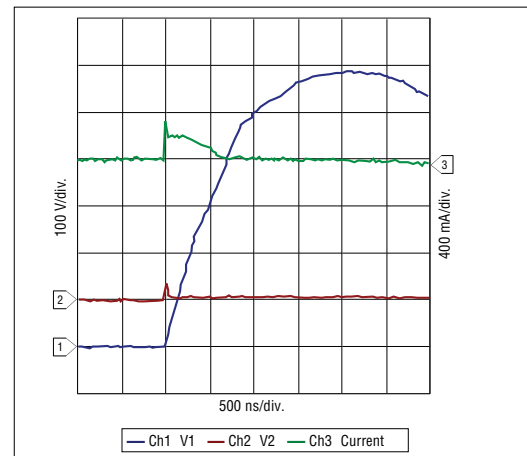
## Reference Designs

A cost-effective protection solution combines the Bourns® TBU® protection device with a pair of MOVs or Bourns® GDTs and a diode bridge. The diagram below illustrates a common configuration of these components. The graphs to the right demonstrate the operational characteristics of the circuit.

For new SLIC applications, we recommend that customers evaluate our new TBU-PL series.



P850-G Configuration (ITU-T K.20, K.21, K.20E, K.21E, K.45)			
Product	Qty.	Part Number	Source
TBU® Device	1	P850-G120-WH	Bourns, Inc.
MOV	2	<a href="#">MOV-10D361K</a>	Bourns, Inc.
Diode bridge	2	GSD2004S-V MMBD2004S	Vishay Diodes Inc.



P850-G Solution: 4000 V Lightning 10/700 μsec, 100 A

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REV. 09/15

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